Title: Puzzling Pizza Paradigms

Brief Overview:

> Students will be actively engaged in a thematic unit on pizza. Students will work as a class, small cooperative groups, and individually to complete the activities. The topics that will be covered include: data analysis, collection and interpretation, and geometric concepts involving area.

NCTM 2000 Principles for School Mathematics:

> **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
>
> **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
>
> **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
>
> **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
>
> **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
>
> **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

> **Content Standards**
>
> **Number and Operations**
> The students will convert fractions to decimals and percents.
>
> **Geometry**
> Students will determine the area of a circular and a rectangular object given different dimensions.
>
> **Data Analysis and Probability**
> Students will rank data, collect samples, present visuals of the data and compare sample data to a theoretical model. Students will determine the number of combinations for a given situation and answer basic probability questions.

Measurement

Students will determine the area of a circle and a rectangle given the formulas and will represent them in correct dimensions.

Process Standards

Problem Solving

Students will be presented with a number of real world applications. Students will use their prior knowledge to determine an appropriate strategy to solve various problems.

Reasoning and Proof

Students will be required to determine which pizza is the best deal based on serving size and price. Students will be asked to use logical reasoning for a real world application.

Communication

Students will be required to work in cooperative groups and individually. They will present their conclusions and explanations using the language of mathematics and communicate in both written and verbal formats. Students will be required to participate in teacher-facilitated discussions related to the topic.

Representation

Students will be required to present results in both visual and written formats.

Grade/Level:

Grade 6-8, all ability levels

Duration/Length:

5 days/50 minute periods

Prerequisite Knowledge:

Students should have working knowledge of the following data:

Fractional representation of data, decimals and percents
Concepts of determining the area of circles and rectangles
Interpretation of data in a visual format

Student Outcomes:

Students will:

Provide ranks in a survey
Collect sample data

Represent data in a circle graph
Interpret simple data
List combinations in a real world application
Analyze, compare, and interpret data in order to draw conclusions

Materials/Resources/Printed Materials:

Student activity packet
A set of transparencies for classroom use of student packet
Pizza for an end of unit celebration

Development/Procedures:

Day 1

Students will be introduced to the thematic unit, <u>Puzzling Pizza Paradigm</u>, on pizza. Students will complete a reading stance question related to pizza in the U.S. and around the world, "Pizza Around the World" worksheet.   Students will complete Activity 1 – What do you prefer? Students will collect class data that will be needed in Activity 2.

Day 2

Teacher-facilitated discussion related to motivational activity on market shares of pizza chains will be given.   During this time teacher will informally assess students prior knowledge of pie charts and their interpretation. A review of these concept will be given if needed.

Students will then complete activities 3 and 4.

Activity 3 – In "A picture speaks a thousand words!" worksheet, the teacher needs to make sure students understand the directions. A good idea would be to model how to complete the first row of the chart. Remind the students that the graph is divided into 20 sections. Ask the students how many degrees would each section include?

Activity 4 – How do we compare?
A class discussion of their results as compared to Maryland results should be conducted before students complete the written response.

Teacher will assign Activity 5 – Pizza, Pizza to be completed for homework.
The format of the assignment will be discussed before students leave the classroom.

Day 3
Activity 5 will be reviewed at the beginning of class. Student volunteers will share their solutions. Activity 6 – "What's the order?" will then be completed. individually by the

entire class. For the remainder of the period, a review of the concept of area, formulas for determining area, and dimensional units will be conducted in preparation for Activity 7. Several examples of finding the area of circles and rectangles should be given to the students.

Day 4

Students will complete Activity 7 – Buying Pizza-What's the Best Deal? Students will complete Questions A-D with a partner. A teacher-facilitated discussion will follow so all students are clear on the expectations before completing the rest of Activity 7 independently. Students will complete the remainder of Activity 7. This should be finished for homework if not completed at school.

Day 5

Students will share individual conclusions as to the best place to buy pizza. Arrangements will already have been made by the teacher for the class to share a large pizza for lunch. Students have to earn a lunch ticket by completing an individual question related to the unit. (see Sample Student Questions) The teacher will use the responses as an informal assessment to the unit in order to prepare students for a performance based assessment. Students will complete the assessment at home. A scoring key and two rubrics have been provided for the teachers.

Performance Assessment:

Students will complete a mini performance assessment based on favorite dinner choice of the middle school student. This assessment will highlight the skills presented in the unit. See assessment titled – What's for Dinner?

Extension/Follow Up:

Students can collect data from school cafeteria and determine student preferences in relation to the number of times the particular food is served in the cafeteria.

Authors:

Elizabeth Flow-Delwiche   Charlotte Soracoe
Catonsville Middle School   Catonsville Middle School
Baltimore County, MD   Baltimore County, MD

Puzzling Pizza Paradigms

Over the next five days you will perform several activities dealing with the topic of pizza. These activities will prepare you to solve a real world problem involving food selection. HAVE FUN!!

Read the following information regarding pizza to prepare for the written response.

Pizza in the US

Did you know ???

- Approximately 3 BILLION pizzas are sold in the U.S. each year.

- Americans eat approximately 100 acres of pizza EACH DAY, or about 350 slices per second.

- According to a recent Gallop Poll, children between the ages of 3 and 11 prefer PIZZA over all other food groups for lunch and dinner.

- 93% of Americans eat AT LEAST one pizza per month. (Source: Bolla Wines.)

- 94% of the population of the U.S. eats pizza. (Source: Parade Magazine.)

- Each man, woman and child in America eats an average of 46 slices, (23 pounds), of pizza per year. (Source: Packaged Facts, New York.)

http://pizzaware.com/facts.htm

Pizza Around the World

Around the world, toppings vary greatly, reflecting regional tastes and preferences. In Japan, for instance, eel and squid are favorites. In Pakistan, curry is a big seller. In Russia, red herring is the topping of choice. Australians enjoy shrimp and pineapple, as well as barbecue toppings on their pies. Costa Ricans favor coconut.
(Source: Numero Uno Pizzeria.)

Some of the more popular international toppings are pickled ginger, minced mutton and tofu in India; squid and Mayo Jaga (mayonnaise, potato and bacon) in Japan; and green peas in Brazil. In Russia, they serve pizza covered with mockba; a combination of sardines, tuna, mackerel, salmon and onions. In France, a popular combo is called the Flambee, with bacon, onion and fresh cream.
 (Source: Domino's.)

http://pizzaware.com/facts.htm

Explain how your knowledge about pizza has remained the same or changed based on the information you have read. Use prior knowledge and details from the text to support your explanation.

Activity 1: What do you prefer?

Goal: Rank toppings on a pizza.

Directions: Using the table individually rank the following one-topping pizzas according to your preference. A score of one will indicate that pizza topping is your favorite and a score of 5 will indicate your least favorite pizza topping.
Note: You may only use a number once----You must make a decision regarding the rankings; there can be no ties.

Topping	Rank
Pepperoni	
Mushroom	
Double Cheese	
Sausage	
Onion	

Activity 2: What's number one? Class Data Collection

Goal: You already know what you like best so, let's poll the class to determine if they agree with you. For this activity we will work as one group.

Directions: Assign one person in the class to fill in the counts for the class. When your number one topping is called, raise your hand. You must only raise your hand for the topping ranked number one.

Topping	Class Count
Pepperoni	
Mushroom	
Double Cheese	
Sausage	
Onion	

Number of students in the class: _____. (This number should be the same as the sum of the column labeled class count.)

Activity 3: A picture speaks a 1000 words.....
Converting data into a visual format

Goals: Convert count for class data into relative frequencies. Using the relative frequencies, construct a pie/circle graph.

Directions: Convert the class data from Activity 2 to relative frequencies to be used for the circle graph. To do this, divide each individual topping count by the total number of students in the class. Convert to a % by multiplying by 100. Example: If there are 10 students in the class and five prefer pepperoni, the relative frequency will be 5/10*100= 50%. Fill in the table with your values.

| Topping	Class Count	Fraction	Percent
Pepperoni			
Mushroom			
Double Cheese			
Sausage			
Onion			

Using the numbers in the last column, transfer the data to a visual format. The pie chart below has guidelines to aid in your converting.
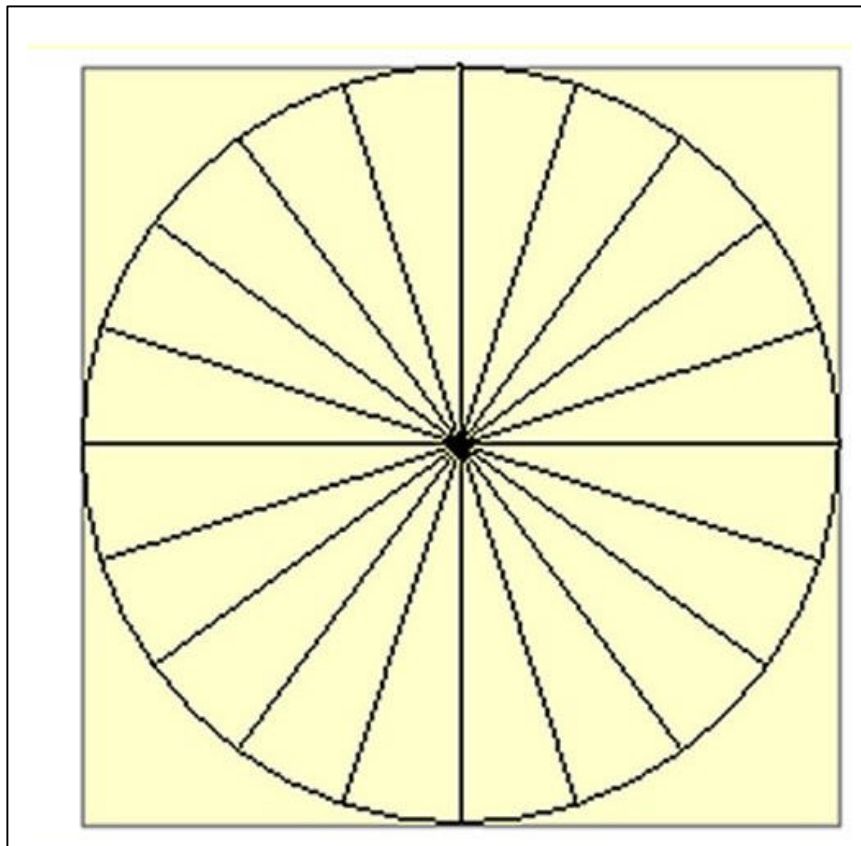
Activity 4: How do we compare?

Goal: Determine how the class data compares to the model. Make predictions for the expected values to aid in the comparisons

Directions: Visually compare the pie chart that you constructed using class data (Activity 3) with the model below. Write at least two statements comparing our class results to the preferences typically found in Maryland.
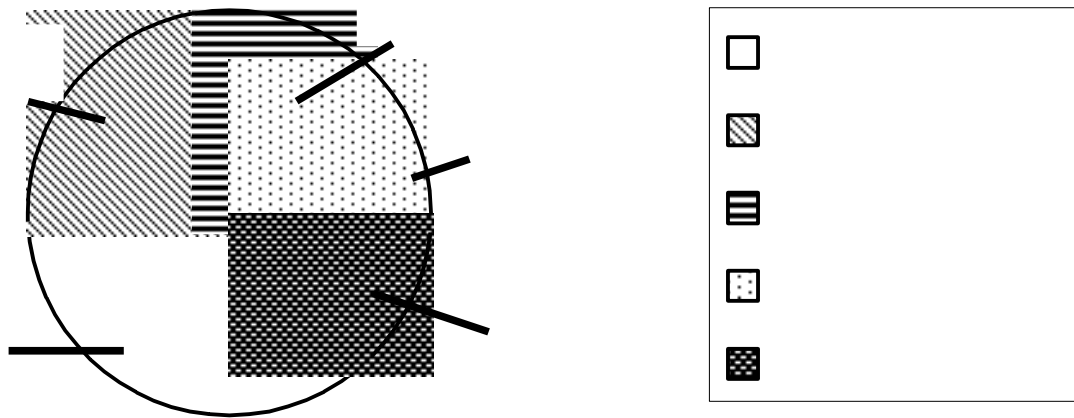
Response:

Activity 5: Pizza, Pizza

Goal: To determine the number of different two-topping pizzas that can be made using the following toppings: pepperoni, extra-cheese, mushroom, onion, sausage.

Directions: List the different kinds of two-topping pizzas that can be made using the following toppings: pepperoni, extra-cheese, mushroom, onion, sausage. You can not use double toppings i.e. you should not consider pizza with pepperoni, pepperoni as a different choice.

Hint: There should be 10.

Activity 6: What's the order?

Goal: Using the sample space for two-topping pizzas, apply knowledge to a real-world application.

Question; You have just been hired to work at the local pizza parlor. You answer the phone to take your first order. Unfortunately, the person is calling using a cell phone. You know you hear the word pepperoni but the second word is fuzzy. What is the probability that you will correctly recreate the order and keep your job if you have to guess the second item? Justify your response.

Activity 7: Buying Pizza-What's the Best Deal?

You are searching for the best price for your favorite pizza. You decide to compare size and price at three of your favorite restaurants: **Papa Johns, Dominos and Ledos.** You will need to check the size of the pizza, cost of each topping, and the amount of pizza you will be purchasing.

PAPA JOHN'S ® PIZZA

	Small 12 inches	Medium 14 inches	Large 16 inches
Cheese pizza	$5.99	$9.99	$11.99
One topping	$6.98	$11.48	$13.68
Additional Topping	$.99	$1.49	$1.69

DOMINO'S ® PIZZA

	Small 12 inches	Medium 14 inches	Large 16 inches
Cheese pizza	$7.49	$8.49	$10.49
Additional Topping	$.99	$1.25	$1.50

LEDO'S ® PIZZA

	Small 9 in. x 9 in.	Medium 10 in. x 14 in.	Large 14 in. x 18 in.
Cheese pizza	$4.75	$7.75	$11.45
One topping	$5.25	$8.50	$12.95
Two toppings	$5.75	$9.25	$13.95

A. Your family usually buys pizza with two toppings on it. Complete the table below by pricing each pizza at each restaurant. Show your math work in the table below.

	Small (2 toppings)	Medium (2 toppings)	Large (2 toppings)
Papa Johns ®			
Dominos ®			
Ledos ®			

B. Use math to explain how you determined your answers for each medium pizza at each restaurant. Use words, symbols, or both in your explanation.

_____
_____
_____
_____
_____
_____

C. Ledo's pizzas are not round; they are rectangular in shape. They even use this unusual feature in their advertisements. Do you think a person gets more for their money by buying a Ledo pizza than a Papa John pizza of the same size? Justify your answer from previous experience and the data that is presented in this pizza unit up to this point.

_____
_____
_____
_____
_____
_____

D. How would you prove whether Ledo's pizzas are a good deal or not?

_____
_____
_____
_____
_____
_____

E. Use the information in Activity 6, and determine the area for each size pizza at each restaurant. Complete the table below.

Formulas: Area of a circle = pi x radius x radius

Area of a rectangle = length x width

PAPA JOHNS ® AND DOMINOS® PIZZAS

Small (12 inches)	Medium (14 inches)	Large (16 inches)

LEDO' S ® PIZZA

Small (9 in x 9 in)	Medium (10 in x 14 in)	Large (14 in x 18 in)

F. Complete the following table to aid in the response to the questions that follow.

NOTE: Use the prices for a two topping pizza determined in Activity 7A – "Buying Pizza-What's the Best Deal?" and the areas calculated in Activity 7E.

	Price Small ($)	Price Medium ($)	Price Large ($)	Area Small (inch^2)	Area Medium (inch^2)	Area Large (inch^2)	Cost (price/inch^2) Small	Med.	Large
Papa John's ®									
Domino's									
Ledo's ®									

F. (continued) - Now that you have all of the above information, at what location would you buy each type of pizza with two toppings listed below. Justify your decision using mathematics. Use words, symbols, or both in your explanation.

Small pizza:

_____
_____
_____
_____
_____
_____

Medium pizza

_____
_____
_____
_____
_____
_____

Large pizza:

_____
_____
_____
_____
_____
_____

SCORING KEY FOR PIZZA PARADIGMS

Areas Assessed	Score			
(Use rubric A or B as indicated)	3	2	1	0

Day 1

Response to reading stance question (B)

Activity 1/Activity 2   (A)

Day 2

Calculations and Circle Graph (A)

Activity 4 – Response with justification (A)

Day 3

Activity 5 – Combinations   (A)

Activity 6 – Response with justification (A)

Day 4

Activity 7 - Question A (A)

Activity 7 - Question B (A)

Activity 7 - Question C (A)

Activity 7 - Question D (A)

Activity 7 - Question E (A)

Activity 7 - Question F (A)

RUBRIC A

3:     All calculations are correct. Students can communicate math ideas, processes and concepts. Student's written responses show clear and logical thinking. All regions labeled with the correct percentages and title on the graph.

2:     Some calculations are correct. Students show some ability to communicate math ideas, processes and concepts. Student's written responses show some level of logical thinking. Missing the label and title on graph.

1:     No calculations are correct, but effort was demonstrated. Students show little to no ability to communicate ideas, processes and concepts. Student's written responses show little to no level of logical thinking.

0:     Student did none of the calculations or showed any communication of ideas, processes and concepts. Student did not have a written response.

RUBRIC B

2:      This response demonstrates an understanding of the text with full and developed evidence of connections, extensions, and examinations of meaning. The reader gives at least two examples of information that use prior knowledge and/or evidence from the text. The response is text based/text referential.

1:      This response demonstrates an understanding of the text with limited evidence of connections, extensions, and/or examinations of meaning. The reader gives only one example of information that uses prior knowledge and/or evidence from the text. The response is text based/text referential.

0:      Blank, incorrect answer, off topic or illegible.

SAMPLE STUDENT QUESTIONS FOR INFORMAL ASSESSMENT

EXPLAIN HOW YOU CALCULATED THE PERCENTAGE OF OUR CLASS WHO PREFERRED PEPPERONI AS A PIZZA TOPPING.	HOW MUCH DOES A SMALL 3 TOPPING PIZZA FROM PAPA JOHNS COST? EXPLAIN HOW YOU GOT YOUR ANSWER.
EXPLAIN HOW YOU CALCULATED THE PERCENTAGE OF OUR CLASS WHO PREFERRED SAUSAGE AS A PIZZA TOPPING.	HOW DID OUR CLASS PREFERENCE FOR PEPPERONI TOPPING COMPARE WITH THE STATE OF MARYLAND PREFERENCE? EXPLAIN.
EXPLAIN HOW YOU CALCULATED THE NUMBER OF DIFFERENT 2 TOPPING PIZZAS YOU CAN MAKE WITH 5 TOPPINGS.	WHAT IS THE PROBABILITY OF A PERSON FROM OUR CLASS ORDERING A PEPPERONI PIZZA TOPPING? EXPLAIN.
HOW MUCH DOES A LARGE 3 TOPPING PIZZA COST FROM DOMINOS? EXPLAIN.	IF YOU WERE GOING TO BUY A SMALL, ONE TOPPING PIZZA, WHERE WOULD YOU BUT IT? WHY? EXPLAIN.
HOW DID YOU DETERMINE THE PRICE PER SQUARE INCH OF A LEDO SMALL PIZZA? EXPLAIN.	HOW DID YOU DETERMINE THE PRICE PER SQUARE INCH OF A LARGE DOMINOS PIZZA? EXPLAIN.

What's for Dinner?

For the next two days you will be completing a series of activities to help you answer the question "What's for dinner?". This assessment will require you to apply your knowledge from the activities completed on "Puzzling Pizza Paradigms." Have Fun!!!!

Student Preference:
What is your favorite dinner and why?

Data Collection:
Seventy-five middle school students were asked to indicate their favorite dinner. The survey of the middle school students is presented below. Examine the data and determine what the students surveyed prefer for dinner. Rank the preferences of the middle school students. Provide a written response with justification from the text.

Dinner	Number of Students
Spaghetti and Meatballs	15
Hot Dogs	5
Pizza	16
Hamburgers	15
Macaroni and Cheese	24

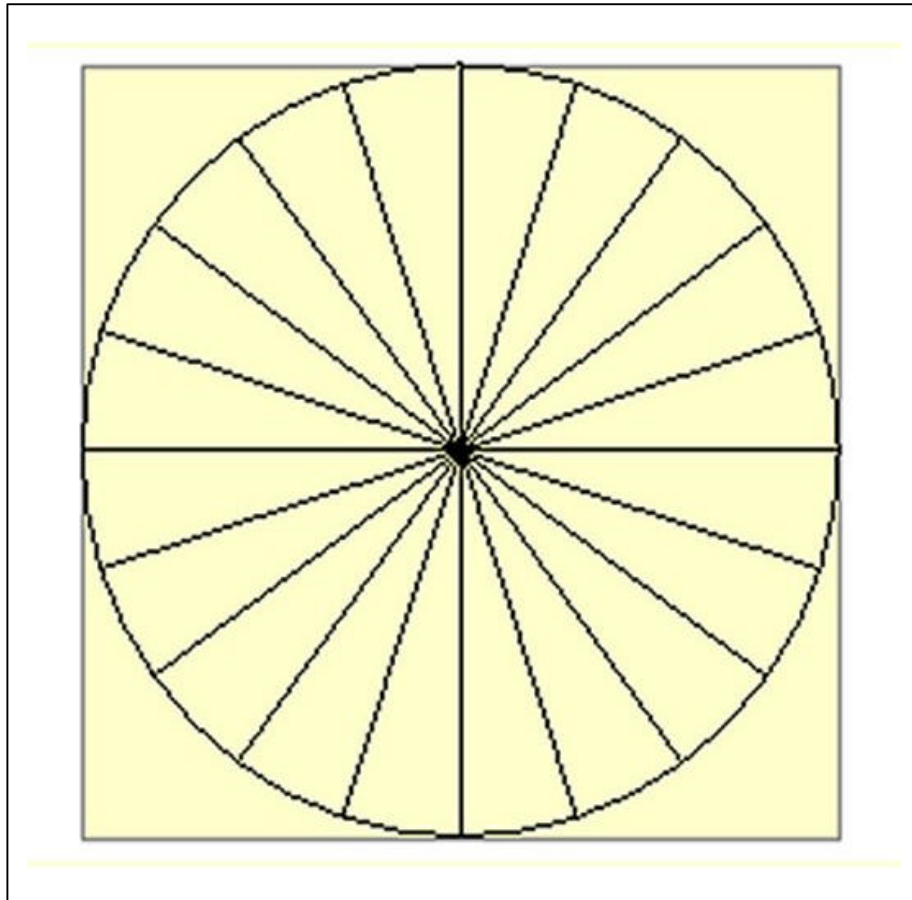| |
|---|
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

A Visual Representation

Complete the following table to aid in the construction of a pie/circle graph.

| Dinner	Number of Students	Fraction	Percent(%)
Spaghetti and Meatballs	15		
Hot Dogs	5		
Pizza	16		
Hamburgers	15		
Macaroni and Cheese	24		

Using the calculations in the last column, complete the circle graph. Remember to label each piece and include a title.

Title:_____

Compare the Model with the Sample

Indicated below is the theoretical model of favorite dinners for middle schoolers. How does the sample data compare with the model? Provide a written response with justification from the text.

Model of Dinner Preferences

Burgers
15%

Pizza
35%

Spaghetti
25%

Hot Dogs
5%

Macaroni
20%
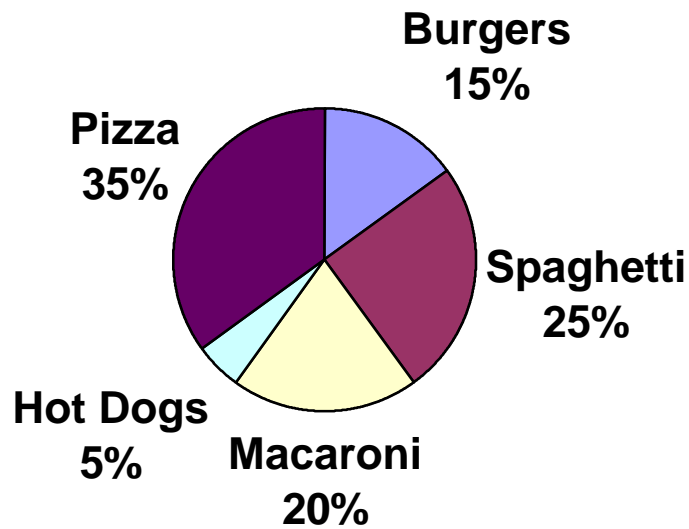
To: Teacher
Re: Grading of Assessment

The final assessment will use the grading tools given in the lesson. The students will be familiar with the expectations of the unit and the grading scale.